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ABSTRACT

The savings to students from living at home and commuting to school are estimated in this paper. By relating these savings to enrollment growth, several conclusions are reached as to how the presence of a local college affects the demand for higher education. The report is divided into four parts: (1) formulation of a framework for computing the savings students obtain by attending a local college; (2) application of this framework to a cohort of second year students at Miami-Dade Junior College (Florida); (3) classification of these students by family income to determine what income groups benefit the most from these savings; and (4) analysis of the addition to enrollments for local junior colleges because of these savings estimates. Findings suggested that the presence of any institution of higher education results in increased college attendance in that area because of commuting savings. The presence of a junior college especially increases the college attendance of low income students although middle income families receive the largest percentage of dollar savings. (AL)

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THE ENROLLMENT INDUCING EFFECTS OF LOCAL COLLEGES

Howard P. Tuckman*

What is the effect of distance on the demand for a college education? Studies by Corcoran and Keller and Russell and Richardson found the distance from a college to a student's home is inversely related to the demand for college. On the other hand, Sewell and Fenske conclude that college demand is unrelated to distance.[1] These contradictory findings may be explained by differences in the variables used by the researchers, by the fact that they concentrated on different states, and by their emphasis on aggregate variables such as the proportion of a county's college age population in college.

In this paper we develop estimates of the savings obtainable if a student lives at home and commutes to school. By relating savings to estimates of the price responsiveness of college enrollment we are able to reach several conclusions as to how the presence of a local college affects the demand for higher education. Part I provides a framework for computing the savings students obtain by attending a local college. This framework assumes that if a local college is not available in the student's community he will choose the same type of college at some other location. In Part II, this framework is applied to a cohort of second year students at the Miami-Dade junior colleges to arrive at

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savings estimates. Part III distributes these by income class and Part IV uses the savings estimates to analyze the addition to enrollments resulting from local junior colleges. Our findings suggest that the presence of a local junior college results in an increase in enrollments in institutions of higher education and an increase in the proportion of college bound students choosing to attend a junior college.

A Framework for Estimating Savings

If students, acting alone or in conjunction with their parents, are rational, they will live at home when they find it less costly--in both a monetary and non-monetary sense--then living away. As the distance from their home to a local college increases, the monetary savings from commutation decrease. Suppose that students commute to college by car on the average of q days each month. If each mile costs x cents in direct road costs (i.e. gasoline, tire wear, etc.) and t cents in opportunity costs (viz., the value of time foregone) then the cost of traveling one mile (c) is

$$(1) \quad c = (x + t)$$

Total monthly commutation costs (T) are

$$(2) \quad T = 2cdq$$

where d represents the number of miles traveled between home and school.[2] Any additional costs of living at home are assumed to be unrelated to distance and are denoted by H. In the analysis that follows, H is assumed to be zero.

Students not living at home usually rent a room on or within walking

distance of the campus. If average monthly room rent is R then the difference between what the student would have paid in rent had he lived away from home and what he does pay living at home and commuting represents the savings (S) from being able to attend a college located nearby.[3] R includes all additional monetary payments associated with living away from home.

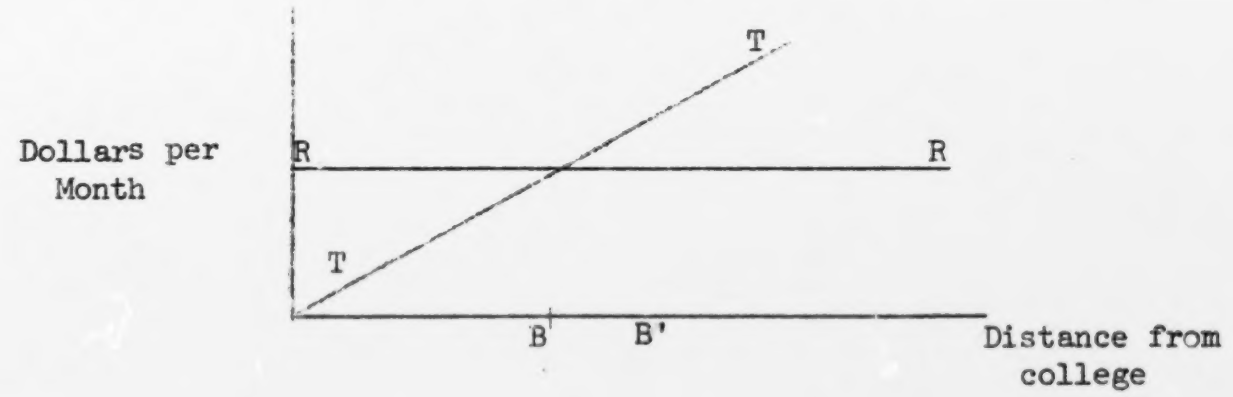
$$(3) \quad S = R - (T + H)$$

Equation (3) provides a reasonable estimate of the savings received by students. Although land values may adjust to reflect the capitalized value of the savings this has little effect on our estimates. The discounted benefits of two years of commutation add little to the present value of the house.[4]

It might also be argued that the families of commuting students incur an implicit cost by not selling their house and moving into a smaller one. However, high closing and mortgage renegotiation fees impose transaction costs which reduce the incentive for families to move frequently. Even if the student's family lives in an apartment, its moving costs, desire for space, and its preference for an extra room for their college bound child may cause them to keep a vacant room.

Land values may also rise to reflect the amenity value of a local college. College increase the value of property largely through the externalities they provide to community residents. In a community like Princeton these externalities may be substantial: a small Junior college placed in Pensacola, may have little or no effect on property values. We shall ignore these effects in calculating the savings to students.

Equation (3) can be expressed graphically. Total monthly commutation costs and room rents are shown on the vertical axis and distance from the college appears on the horizontal axis. Line T-T shows the relationship between distance from the college and commutation costs (its slope is 2cq). Line R-R indicates the rent paid by a student living away from home; net of non-monetary gains or costs.



Students residing at any distance to the left of the breakeven point B can reduce their college attendance costs by living at home. The resulting savings are shown by the distance between lines R and T. If the college has an open door policy then savings are potentially available to all high school graduates. These savings may be viewed as a type of public good. Over large numbers of students one student's savings do not affect another's, no students are excluded, and all students at a given distance from the school can obtain the same savings. If a college is highly selective in its entrance requirements or if the college is so large that traffic congestion sets in, the savings have the characteristics of an impure public good.[5]

To estimate the gross value of the actual savings to students living

at home as compared with those living away we weight the difference between R and T at each mile from the campus by the college attendees living at that distance. The total savings (S^t) to students attending a local college are

$$(4) \quad S^t = NR - 2cq \sum_{i=1}^{B} p_i n_i d_i$$

where n_i represents the number of local college attendees living d miles from the campus, N shows the total number of local college students living at home within B miles of the campus and p_i gives the proportion of students choosing to live at home.[6]

Equation (4) provides an estimate of the savings to students if all of the students attending a local college were willing to go to another college in a different community if the local college did not exist. As we shall show, however, the presence of a local college induces more students to attend college than otherwise might. As a result (4) overstates the total savings but it understates the true value of having a local college.

Estimate of Savings to Miami Students

How much money can students save by living at home and commuting to the Miami-Dade junior college? Information on commutation patterns, costs of travel, and room rentals was obtained from virtually all spring term associate degree registrants at the two Miami-Dade junior college campuses in the spring of 1970. Using student addresses as reported on a questionnaire and student estimates of the distance to campus, each student was placed in an appropriate distance interval from the campus.

To obtain commutation costs per mile, opportunity costs are derived from the average travel time and distance reported by the students. Average time required to travel one mile (3.7% of an hour) multiplied by the average hourly wage for manufacturing workers in Miami gives the dollar value of time spent in travel (10¢ per mile). The manufacturing wage is used since employment in manufacturing is the most likely alternative for students not continuing their education. We assume that students value their leisure at the same rate that they value their work and that marginal and average wages are equal.[7] Since direct travel costs vary depending upon whether depreciation and maintenance costs are included, Table 1 provides both a 5¢ and a 10¢ per mile estimate of direct road costs.

On the average, students living in apartments near campus paid $105 per month in rent. This is lower than the average rent paid by all Miami residents because students generally live in lower quality housing or share their apartments with several others. Our estimates assume that any incremental costs other than rent are offset by the incremental benefits of living away from home. The average value of $\underline{S}^t$ for each distance appears in column 1 and 2 of Table 1 while total cumulative savings appear in columns 3 and 4.

(Table 1 about here)

Breakeven distance ($\underline{B}$) is 17 miles using the 15¢ per mile estimate and 13 miles using the 20¢ per mile estimate. Almost 85% of the total students in the sample live within the breakeven distance and the mean distance traveled to campus is 9.1 miles if all students are included in

TABLE 1

ESTIMATED SAVINGS OBTAINED BY STUDENT'S IN THE SAMPLE
(Savings in Dollars)

Mileage[1] (Home to Campus)	Average Amount Saved by Living at Home		Total Cumulative Savings for both Junior Colleges	
	@15¢ Commutation Cost	@20¢ Commutation Cost	@15¢	@20¢
1	$102	$101	$ 1326	$ 1326
2	96	93	6414	6242
3	90	85	15864	15167
4	84	77	28464	26717
5	78	69	40242	37136
6	72	61	47658	43419
7	66	53	52872	47606
8	60	45	58212	51611
9	54	37	60696	53313
10	48	29	61560	53835
11	42	21	62526	54318
12	36	13	62922	54461
13	30	5	63042	54481
14	24	---	63210	-----
15	118	---	63300	-----
16	12	---	63324	-----
17	6	---	63336	-----

Source: Based upon distance estimates obtained from Miami map and formula discussed in text. Cost estimates assume students travel a distance equal to the midpoint between this interval and the previous one.

the estimate or 5.7 miles if only those within 17 miles are included. If a higher wage rate is used, the B distance declines. The existence of low gasoline prices or of a low cost mass transit system pushes B to the right.

Students commuting from distances beyond the breakeven point may place a positive value on the non-monetary benefits from living at home. These include both "free" services to the student, such as laundering and housekeeping, and services provided by students to their parents such as yard cleaning, etc. Including non-monetary benefits directly in our analysis raises the value of the subsidy and moves the breakeven point to the right (B') if the positive benefits of living at home outweigh the negative benefits.

The Distribution of Savings by Income Groups

What percentage of the high school graduates living close to a college campus and attending that college are poor? And which income groups benefit the most from the presence of local junior colleges? While these are difficult questions to answer when applied to the nation as a whole, we are able to examine the claims that junior colleges are of greatest benefit to the poor in the Miami-Dade area.

Total savings by income group appear in Table 2. Savings received by students at the North and South campus are summed at each distance and dollar amounts are allocated to each income interval according to the percentage of the total students within that interval attending junior college. For example, the total savings to those living one mile from the

campus is $1,313. About 23% of this amount or $304, goes to students from families with reported incomes from $3,000 - $4,999. Similarly, 11.5% or $151, goes to students with total family incomes between $5,000 - $6,999. By summing up the savings for each income class, we obtain a monthly total of $54,481 for the students in the sample. The last line of Table 2 shows the percentage of total savings received by each income class.

(Table 2 about here)

The family income estimates are based on student reports and thus may be somewhat biased since some students have limited knowledge of their parents' income. Nonetheless, both the mean and median incomes for our sample appeared reasonable when compared to census data and to an independent Board of Regents survey.[8] Moreover, the incomes reported by students generally fall within the range associated with student reports of father's occupation.[9]

Table 2 indicates that students from families with incomes of $7,000 and over received about 75% of the total savings for students in the sample. Less than 7% of the savings go to students with family incomes below $3,000. Families with incomes between $7,000 and $15,000 receive the largest percentage of total savings since their children constitute a larger proportion of the total students in junior college than do the children of the poor. This finding may be somewhat unique to the Miami-Dade junior college since recent Office of Education estimates indicate that in 1968 over one third of all entering freshmen with incomes below $7,970 attended two year colleges.[10] Nonetheless, very few of the

TABLE 2

TOTAL SAVINGS BY FAMILY INCOME OF STUDENTS IN THE SAMPLE
(Using 20¢ per mile estimate)

Mileage (Home to Campus)	0-$2,999	$3,000-4,999	$5,000-6,999	$7,000-9,999	$10,000-14,999	$15,000-19,999	$20,000+	Total Cost Savings
1	---	$304	$151	$252	$252	$ 50	$304	$1313
2	650	517	---	1039	1557	516	650	44229
3	430	850	633	2340	2340	635	1697	8925
4	243	1224	1964	1478	3442	1721	1478	11550
5	1011	563	781	1907	3251	1229	1677	10419
6	535	667	667	805	1603	667	1339	6283
7	263	611	347	1134	958	263	611	4005
8	517	---	128	905	777	645	1033	4005
9	---	189	378	189	284	378	284	1702
10	27	32	82	100	150	91	40	522
11	---	24	48	48	145	145	73	483
12	3	3	27	37	47	16	10	143
13	---	4	1	5	6	4	---	20
Total Savings in Each Income Class	$3679	$4988	$5207	$10,239	$14,812	$6360	$9196	$54,481
Percentage of Total Savings for this Income Class	6.8	9.2	9.6	18.8	27.2	11.7	16.9	100.0

children from families with incomes below $3,000 go to college.

Since our student cohort consists of second year students and since low income students are more likely to drop out after the first year, Table 2 understates the proportion of savings to low income students. However, a separate Board of Regents study of the family income of entering students suggests that correcting for the understatement would not change the estimates significantly.[11]

The above estimates of the savings to college attendees are based upon the number of students receiving associate of arts degrees. To convert the savings estimates to include all students at the Miami-Dade junior college two alternative bases are available. Using the 18,907 full-time equivalent students at the Miami-Dade campus in the 1969-1970 school year as a base, and a 20¢ per mile commutation cost, we estimate the total savings to students at the campus to be $11.3 million for a nine month period. Alternatively, if the 23,912 full term enrollees are used as the base then total savings rise to $13.6 million.[12]

The Price Elasticity of Demand for Junior Colleges

The difference between the tuition paid at junior colleges and at a public or private university is dramatic and increasing with time. The average tuition paid at public universities rose from $265 in 1961 to $527 in 1971 while average public junior college tuition rose from $88 to $174.[13] In response to the lower costs of attending junior colleges we might expect to find two types of students in attendance; those who can not afford a university education and who, in the absence of a junior

college would have entered the labor force, and those whose demand for a college education is price inelastic but whose choice of school is price elastic. While these groups can not be easily separated, it is likely that the former will be found among low income families while the latter will be found most often in the middle and upper income brackets.

A recent study by the Massachussetts-Metropolitan Area Planning Council (MMAPC) calculated price elasticities of demand net of the costs of commutation. The authors found that male students had price elasticities of -.27, -.23, and -.10 for public universities, private 4 year colleges and junior colleges respectively. Equivalent price elasticities for women were -.11, not significant, and -.08. The percentage of enrollments is half as price elastic for junior colleges as it is for public universities and other four year schools.[14]

How does the presence of a local junior college affect the percentage of students enrolled for higher education in an area? Our data do not permit us to answer this question directly but a rough answer can be obtained from the MMAPC study. The dependent variable in the MMAPC study is the percentage of tenth grade high school students in 1960 who attended college in 1963, and the independent variables are junior college tuition, public four year tuition, tuition at a teachers college, private four year tuition, father's education, average income of production workers, ability and unemployment. The regression coefficient for junior college tuition, its T-value, and the R^2 of the estimated regressions appear below.

Students Whose Father's Education Is In	R^2	Regression Coefficient	T-Value
All Enrollments	.77	-.011	(3.14)
Lowest Quartile	.54	-.007	(2.06)
Second Quartile	.41	-.009	(1.49)
Third Quartile	.45	-.005	(1.19)
Fourth Quartile	.49	.006	(0.57)

The MMAPC coefficients suggest that students from low education homes are the most likely to be affected by changes in the price of junior colleges while students from high income homes are not significantly affected by a price change. Since a strong correlation exists between income and education the following conclusion seems warranted: If students consider the savings described above in calculating college costs then a reduction in the number of local junior colleges would have a greater effect on the enrollments of low income students than of high income students. Thus, even though the savings received by low income families as a group are less than those received by middle income families the effect of the cost savings in determining whether a student from the low income group will attend junior college will be greater.

Having discussed the effects of savings on the demand for higher education we shall now quantify their effect on enrollments in junior colleges. In a recent study conducted in California, Hoenack attempted to estimate the proportion of high school seniors attending the nearest junior college using price and income variables to explain the observed variation in student choice.[15] He found that a $100 increase in junior

college tuition diminishes enrollments by about 7 percent. If a junior college was not available in the Miami area and if students chose to live away at an equivalent junior college in some other area, then their direct costs would rise by at least $590--the average savings to a Miami-Dade student. Using Hoenack's estimate, we would expect junior college enrollments to fall by about 40 percent. Apparently, the savings made possible by the presence of a junior college play an important role in affecting the choice of the marginal student.

This conclusion helps to explain an earlier study of Wisconsin students which showed that the presence of a college within a county results in a larger proportion of students attending that type of college than in non-college areas. Table 4 presents some of the results from that study. The entry in row one, column one shows the mean percentage of students from counties containing a state college who choose to attend a state college. Row one, column two gives the percentage of students from counties with a state college who chose to attend a private college. The underscored diagonal shows the attendance at a college of the same type as exists in the county. Note that the findings suggest that the savings made possible by the presence of <u>any</u> type of college affect the enrollments of that college.

Table 4. Type of College Chosen by Wisconsin Students by Type of College in Their County, 1967 Data*

Type of College In a Student's Home County	Percent of Students Choosing A State College	Private College	University Wisconsin	Extnsn Center	Junior College o Teachers College
State College	84.7	1.3	8.4	.5	---
Private	58.7	16.7	11.3	1.3	2.3
U.W. and private College	38.5	13.0	45.5	1.5	---
Extension Center	43.5	2.5	8.0	35.5	2.5
Junior College or Teachers College	59.0	2.8	11.2	4.3	11.8

*Column totals do not add to 100% since the data source did not contain information on the type of college attended by students in groups of less than 5. Source: H. Tuckman, "College Presence and the Selection of a College," Land Economics, May, 1971.

Conclusions

Over 60 percent of the 400 new colleges built in the last decade are junior colleges. The growth of local junior colleges can be partially explained by the lower state contributions required to educate students. It can also be explained by legislators' desires to provide greater educational opportunities to low income students by building many schools within commuting distance rather than building fewer but larger schools.

This study explores one dimension of the educational opportunity offered to students; namely, the effects of a reduction in the price of a junior college, due to the opportunity to live at home, on the enrollments

in higher education. Our findings suggest that middle income families receive the largest percentage of the dollar savings from having a local college nearby. Nonetheless, the presence of local junior colleges in an area is beneficial to lower income families. Since the percentage of enrollments in a local junior college is price responsive, at least in the lowest income groups, the ssvings obtained from having local junior colleges increase the number of low income students in college.

The demand inducing effects of local colleges are often overlooked by researchers. In a recent article designed to provide criteria for public investment in two year colleges, Heinemann and Sussna fail to consider these effects as a part of their model.[16] Simular oversights may be found in studies by Hirsch and Marcus, and by Hansen and Weisbrod.[17] If educational policy is to be determined on the basis of benefits and costs then the enrollment inducing effects of local colleges must be taken into account.

Footnotes

1. M. Corcoran and R. Keller, College Attendance of Minnesota High School Seniors, Bureau of Institutional Research, University of Minnesota, 1957; J. Russell and T. Richardson, Geographic Origins of Michigan College Students, Legislative Study Commission on Higher Education, Lansing, Michigan, 1957; W. Sewell and V. Shah, "Parents Education and Children's Educational Aspiration and Achievements," American Sociological Review, April 1968; R. Fenske, A Study of Post High School Plans In Communities with Different Educational Opportunities, Ph.D. dissertation, University of Wisconsin, 1965.

2. Time enters into the cost function in a simple linear manner. This is clearly a simplification since congestion close to the campus and access to four lane highways further away might require a function such as $t = a+a_1d-a_2d^2$. Experiments were performed with several non-linear equations of this type but there was no evidence that these forms

provided a better explanation of the observed pattern of student commutation than the simple linear function used in this paper. The monthly costs of living at home are assumed to be zero and x and t are assumed to be unrelated to distance.

3. Since the only purpose of housing in the model is to allow the student to attend college, R represents the rent of an accomodation just sufficient to meet the basic needs of the student. Moreover, if students choosing not to live at home live close to the campus, then R is unrelated to distance and marginal and average rents are assumed to be equal. This tends to understate the size of the subsidy, although not significantly, since Miami's housing market will probably not be significantly altered by an increase in student demand for housing.

4. If immediate capitalization of the subsidy takes place, the existing residents of the area gain both the benefits of commutation and the capitalized increase in the value of the property. Future purchasers of a home are denied the full value of the savings since the sale price of the property increases to incorporate the savings. But full capitalization need not take place if the savings are realized in the future. For example, if the two year savings is $1,140 and if this is realized at a period twenty years later then the present value of the savings using an 8% discount rate is $244.50. Moreover, other uncertainties exist. The larger the number of children in a family the greater the savings to be included in the capitalized value of the property. Thus, the amount to be capitalized seems uncertain at best. Finally, it is likely that the breadwinner's journey-to-work time will dominate family decisions since his opportunity costs will be greater than those of his children.

5. See J. Litvak and W. Oates, "Group Size and the Output of Public Goods: Theory and Application to State-Local Finance In the United States," Public Finance, No. 2., 1970.

6. Equation (4) assumes a discrete rather than a continuous spatial distribution of students. In the estimations students were assumed to live at the midpoint of the distance interval. Congestion costs could be included in the formula by making c a function of N.

7. The theory behind this measure of travel time is well established. In equilibrium students will allocate their time so that the value of one more unit will be equal among the various uses (travel, leisure, work). At the margin, the value of time spent in travel will equal the value of time spent in work. See, for example, R. Gronau, "The Effect of Traveling Time on the Demand for Passenger Transportation," Journal of Political Economy, March-April, 1970.

8. See D. Windham, State Financial Higher Education and the Distribution of Income in Florida (Massachusetts: Health-Lexington, 1970). And U. S. Bureau of the Census, U.S. Census of Population, Florida, Government Printing Office, Washington, D.C., 1960.

9. Measures designed to predict family income from other information provided on the questionnaire were ruled out since previous efforts in this direction have explained less than 50% of the variance in parent-reported income. See L. S. Miller, "Predicting Family Income in the Scope Sample," Department of Economics, Stonybrook, Working Paper No. 7, April 1970.

10. As reported in The Chronicle of Higher Education, March 10, 1969.

11. D. Windham, op. cit. and Board of Regents data for the 1969-1970 school year. These data suggest our estimates are slightly overstated for families with incomes over $10,000 and slightly understated for families with incomes between $5,000 and $10,000. The percentage of students with family incomes below $5,000 remains the same in both studies and the mean family income of students in both studies does not differ by more than 5%.

12. Figures obtained in telephone conversation with Florida Board of Regents.

13. Digest of Educational Statistics, op. cit., (1970) p. 95, p. 75 and p. 70, (1964) p. 99.

14. Higher Education In the Boston Metropolitan Area, Metropolitan Area Planning Council for the Commonwealth of Massachusetts, Board of Education, Volume VI, 1969, pp. 38-39.

15. S. Hoenack, Private Demand for Higher Education in California Office of Analytical Studies, University of California (paper undated) Chapter IV.

16. H. Heinemann and E. Sussna, "Criteria For Public Investment in The Two-year College: A Program Budgeting Approach", Journal of Human Resources, Spring, 1971.

17. W. Z. Hirsch and M. Marcus, "Some Benefit-Cost Considerations of Universal Junior College Education," National Tax Journal, March 1966, pp. 48-57. W. L. Hansen and B. Weisbrod, "The Distribution of Costs and Direct Benefits of Public Higher Education: The Case of California," Journal of Human Resources, Spring, 1969.

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